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Innovation The Research Concept

The Acoustic Properties of Electrolyte With N-Propanole

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Abstract

Acoustic deals with the phenomenon of sound in liquids. it has been termed as the science of description creation and comprehension of human experiences. The Ultrasonic and various behavior of some matter halides (Antimony chloride, Antimony Iodide) with organic compounds (n-propanol) have been studies by different parameters such as Viscosity ()density (), ultrasonic velocity (U) intermolecular free length (L_f), molar sound velocity (R), solvation number (S_n) and relative association (R_a) Specific acoustic impedance (Z) apparent molal compressibility (), and different molar volume The dependent of their properties on Significant Interaction between solute and solvent molecules.

Keywords: Ultrasonic velocity, antimony chloride, iodide, n-propanol, ultrasonic interferometer, viscometer, solvation number, relative association Adiabatic compressibility, specific acoustic impedance, Intermolecular free length.

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Introduction

Acoustic an important branch of science deals with the phenomena of sound. It has been termed as science of description, creation and comprehension of human experience. Ultrasound is the branch of acoustic science which deals with phenomena of frequency above the upper audible limit approximately 20,000 cycle/second, ultrasound wave frequencies above these range cannot be perceived by the human ear. The human ear range can perceive a vibration with in a definite range, 16 up to 20,000 cycle/second. The ultra sounds Frequencies lie between 20 kilo cps to 500 kilo cycle/second are known as ultrasound waves sound waves with frequencies beyond 20,000 cycle/second are known as supersonic waves can travel through liquid & solids. Corlin (1960)[1]. Clickstlin (1960)[2] and crow & Ford (1955)[3], have made studies in application of low energy ultrasonic waves, low energy vibrations are mainly used in destructive testing of materials and so many different fields like as location of defects in materials, measurement of mechanical stress, viscosity and pressure measurement in liquid, to investigate acoustic and thermodynamics properties in pure state and their mixtures etc.

Ultrasonic velocity determination have been carried out in a number of organic liquids, in organic compounds, dilute solution and high polymers of several worker's[4-10]. With development, diffraction, interferometric and pulse technique. On the basis of the theory of inter molecular force attraction explained by Ram Prasad[11], Parthasastry's[12], has shown that lengthing of the molecular chain increase the sound velocity Ramachandra Rao and Nambinarayan[13], studies ultrasound velocity, viscocity and density of oxalic dehydrated in tetrahydro furon and calculated adiabetic compressibility, internal pressure and intermolecular free length. The ultrasound velocity increase known linearly with increasing concentration of oxalic acid and dehydrated indicates association through hydrogen bonding. Monwotkar and Dhonge[14] studied viscosity, density and apparental modal volume in aqueous salt solution at 25º Chimitlorzhiev[15] studied the iodide, sodium, cadmium, zinc in alcoholic solutions such as methanol, ethanol, n-propanol, isobutanol showed that the ultrasound velocity were linear function of square root of concentration.

Experimental

Determination of acoustic parameters such as ultrasonic velocity, specific acoustic impedance (Z), isentropic compressibility etc. are measured by analytical reagent (AR) grade. The purity of the used chemicals was checked by density determination at 32ºC, the values of density obtained tally with the literature values, Binary liquids mixtures of different known compositions were prepared in airtight-stoppered measuring flask to minimize the leakage of volatile liquids. The weighing was done using electronic balance with precision ± 0.01mg. The double walled bicapillary Pyknometer was used for the measurement of densities of solvents and solution[16-17] with an accuracy of ± 0.0005gm/cm^3. An ubbelohde viscometer, having frequency of 2MHz (Mittal Enterprises, New Delhi, Model : F-81) with an accuracy of ± 0.05%18-19, Detailed of Experimental techniques are given elsewhere[18-19].

The viscosities of the various concentration solutions of the metal halides with alkanols were calculated by using the formula where are the viscosity, density, time flow for known & unknown solution respectively

Theory and Calculation

The different thermodynamic parameters such as Isentropic compressibility, (β_S) adiabatic compressibility (), intermolecular free length (L_f), Specific acoustic impedance (Z), apparent molal compressibility (), solvation number (S_n) and relative association (R_a), have been calculated at 32ºC, using ultrasonic velocity (U), density () and viscosity () of these solutions with the help of following equations.

$$\beta = U^2 \times \rho^{-1} \quad ......(1)$$

$$L_f = K \times \beta^{-1/2} \quad ......(2)$$

$$Z = U \times \rho \quad ......(3)$$

$$\phi_k = 1000(\rho^0\beta - \beta^0\rho) / C\rho^0 + (\beta^0 \times M) / \rho^0 \quad ......(4)$$

$$S_n = n_1 / n_2(1 - \beta / \beta^0) \quad ......(5)$$

$$R_a = (\rho / \rho^0)(U^0 / U)^{1/3} \quad ......(6)$$

Where ρ, ρ^0 and U, U^0 are the densities and ultrasonic velocities of solution and solvent, respectively; K is Jacobson constant; M molecular weight of solute; β^0 and β the adiabatic compressibility of solvent, and solution, C is concentration in mole/Liter; and are the number of moles of solvent n_1 and n_2 solute, respectively.

Table- 1
System –Antimony chloride with n-propanol = Temp. 32ºC 0.05ºC
Isentropic compressibility of n-propanol =88.68 cm^2/dyne. 10^{12}

Cmol/lit	g/cm^3	c.p.	U m/sec	cm^2/dyne	cm^2/dyne	g/s.cm	L_f	R_a	S_n
0.0057	0.7816	0.0176	1212	87.09	-356.20	0.9473	0.5911	1.0065	0.8174
0.0114	0.7868	0.0286	1218	85.67	-363.68	0.9583	0.5862	1.0133	0.8237
0.0172	0.7946	0.0528	1227	84.13	-368.18	0.9718	0.5809	1.0202	0.8300
0.0229	0.8012	0.0705	1234	81.01	-370.10	0.9862	0.5748	1.0264	0.8363
0.0287	0.8078	0.0882	1239	80.50	-374.21	0.1008	0.5697	1.0263	0.8426
0.0344	0.8142	0.1059	1248	79.11	-375.10	0.1014	0.5633	1.0389	0.8489
0.0402	0.8209	0.1235	1255	77.59	-376.34	0.1028	0.5579	1.0454	0.8552
0.0458	0.8274	0.1411	1262	75.88	-376.68	0.1044	0.5517	1.0513	0.8615
0.0517	0.8340	0.1588	1270	74.34	-376.89	0.1059	0.5461	1.0574	0.8679

Table-2
System –Antimoney Iodide with n-propanol = Temp. 32ºC 0.05ºC
Isentropic compressibility of n-propanol = 87.60 cm^2/dyne. 10^{12}

Cmol/lit	g/cm^3	c.p.	U m/sec	cm^2/dyne	cm^2/dyne	g/s.cm	L_f	R_a	S_n
0.0030	0.7862	0.0115	1224	84.90	-808.00	0.9623	0.5836	0.9838	2.6879
0.0060	0.7894	0.0242	1240	82.20	-810.25	0.9788	0.5748	0.9856	2.7149
0.0090	0.7932	0.0363	1262	79.45	-812.50	0.1001	0.5635	0.9874	2.7359
0.0120	0.7960	0.0478	1278	76.91	-814.25	0.1017	0.5554	0.9894	2.7669
0.0150	0.8006	0.0606	1296	74.00	-820.50	0.1037	0.5462	0.9912	2.7951
0.0180	0.8042	0.0727	1314	71.25	-821.75	0.1056	0.5374	0.9932	2.8136
0.0211	0.8078	0.0836	1330	68.50	-822.25	0.1074	0.5295	0.9950	2.8346
0.0241	0.8114	0.0969	1350	65.75	-823.50	0.1095	0.5193	0.9970	2.8562
0.0271	0.8152	0.1100	1368	63.50	-824.50	0.1115	0.5104	0.9988	2.8760

Result and Discussion

We have adopted weak electrolyte as in antimony chloride in n-propanol and Antimony Iodide in n-propanol here n-propanol is a polar solvent. Ultrasound velocity, density were measured at 32ºC at different constriction, The resulted acoustic parameters been computed in table-1 and table-2. The concentration derivatives of velocity d_v/d_c is positive i.e. the Ultrasound velocity (U) Increases with increasing concentration of electrolyte with n-propanol, which shows the linearity with molar constriction it is observed that the value of viscosity increases with increasing molar concentration and density of the solution the result of viscosity Indicates there is significant Interaction between the solute and solvent molecule because in halides of Antimony chloride, Antimony Iodide heavier halides group has more Tendency of Electrolyte easily. The intermolecular free length (L_f) decrease while specific acoustic impendance (Z) increases with increase in solute concentration (table-1,2) which can be explained on the basis of lyophobic interaction between the solute and solvent molecule which increases the inter-molecular distance leaving relatively wider gaps between the molecules and thus becoming the main cause impediment to the propagation of ultrasound waves and affects the structural arrangement.

The relative association is influence by two factors[20] (i) the breaking up the solvent molecules on addition of electrolyte to it and (ii) the solvation of ion that are simultaneously present; the former resulting in a decrease and later increasing of relative association. In the present investigation, it has been observed that relative association value increases with increase in concentration. Similar results have been reported in literature[21]. Solvation number (S_n) are calculated using Passnsky equation and are listed in table (1). The S_n values are found to increase with the increase in solute, which also suggested close association between solute and solvent.

Objective of the Study

To determine the Acoustic parameters of Antimony Halide with Alcohol.

Conclusion

The System indicates strong interaction at higher concentration of electrolyte with alcohol and close association between solute and solvent molecules.

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